Abstract

We propose a **surgical** measurement of short-range correlations (SRC), in inelastic electron scattering via the two proton knockout reaction $^3\mathrm{He}(\mathrm{e},\mathrm{e}'\mathrm{pp})\mathrm{n}_{\mathrm{sp}}$. Such correlations have a specific dynamical signature, in the ground state wavefunction of the target nucleus, which bridges the gap between nucleonic and quark degrees of freedom. As such, these measurements will provide severe constraints on existing theoretical models which employ realistic N-N potentials, while at the same time providing the impetus for new calculations.

Our aim will be accomplished by separately measuring the longitudinal and transverse parts of the cross section, **for the first time,** as a function of dynamical observables, in an optimal kinemetical configuration. It is generally acknowledged that the $(e,e'pp)$ channel is an excellent candidate for probing SRC, however, the experiment must be designed carefully in order to minimize competing processes. This is best achieved by carrying out a Rosenbluth separation, in order to access the longitudinal part of the cross section, where the SRC signature is the cleanest and strongest. The optimal kinematical setting for such a measurement is that in which the two ejected protons are parallel and antiparallel, respectively, to the momentum transfer vector, and the energy transfer region of interest ranges from 500 to 900 MeV, with the **missing momentum of the neutron confined to spectator values.** The ^{3}He nucleus has been selected because it is the lightest nuclear system for which the reaction can proceed, realistic wavefunctions are available, and a triple coincidence renders the experiment kinematically complete.

We propose to carry out these measurements using the two high resolution spectrometers in Hall A for detecting the scattered electron and the forward proton. The second proton, at backward angles, will be detected in either a magnetic or a scintillator-based, large solid angle proton detector. We request 436 hours of beamtime at a beam current of 35 μA.